Notebook Series -- Notebooks by Edison
Notebook, N-14-01-01.1

This notebook was used by Edison, probably during the period January-August 1914, and was annotated by him on several subsequent occasions, including January 1, 1916. It consists primarily of notes from the numbered battery record books (*Thomas A. Edison Papers: A Selective Microfilm Edition, Part IV*, Notebooks by Edison and Other Experimenters—Battery Record Books) and other earlier notebooks pertaining to alkaline storage batteries. Included are data and observations regarding the capacity and efficiency of numbered experimental cells. Many of the entries relate to the composition, construction, and treatment of positive electrode "tubes" made with nickel and other metallic flake (including cobalt and bismuth flake) or treated with other metallic additives. Other entries pertain to negative electrode "pockets" made with different preparations of iron, to the use of different electrolyte solutions, and to the possible rejuvenation or "regeneration" of used battery components. Inserted into the book are several loose pages of notes, including a 1910 memorandum from Walter E. Holland to Edison regarding the construction of three experimental cells. The front cover is labeled "Very Important." The pages are unnumbered. Approximately 130 pages have been used.

Arsenate of Hg is sol in KOH

I think Arsenic metal is reduced to metallic if so is there local action, or what –

Sent Formate K formed in our cell in presence of CO_2

Hurts Iron – all cyanide Compounds hurt iron,
Why – Ferrocy Fe decomposed by KOH.
is it Shuttle Ox & Red

Notes Old Green – 1907

Iodides in electrolyte very bad for Nickel reduces capacity more than half.

Arsenic acid is bad for Cell. Arsenate or Arsenite, diminishes Capacity 20 @ 25% 100th run in small test cell –

Formate K is bad, reduces capacity 20 @ 25% 100 Runs.

Tried
2 grms KBr
2 " KCl
2 " NaCl.
2 " NaBr } 100th Run 25% lower than regular

4 Na Sulfide 100 Run OK
2 Na Sulfide 2 KCl 100 OK

4 grms KCl
2 Ferrocyanide K .. 50th run 40% lower capacity

5 grms K Benzoate OK 100
5 " K Bifluoride OK 100 Runs

Saponin

5 grms K Binoxalate OK 100 Run
5 " K Bisulfite OK "
5 " Borax - 6% better "
5 " K Bromate OK "
5 " K Hypophosphite 20% " lower
5 " Duplicate OK "
5 " Lactate K OK "
5 " K Nitrate OK "
5 " K Nitrite OK "
5 " K Orthophosphate OK "
5 " Realgar wouldnt run at all, had to empty and put in fresh KOH 21% show 45% loss of Capacity. Iron was badly injured Nickel not at all-

5 grms Ethylsulphate K - OK - 50th run, it foamed terribly -

5 grms K Silicofluoride OK 50 Run
5 " formaldehyde - OK 50 "

Cobalt peroxide made by Bromine 5.27 grms only gave 18% of Capacity that Nickel does

Iodide Hg Cyanide Hg sol — KOH

Succinate Hg Sol KOH
Acts like sulphur

5 grms	K Cinnamate	OK	50 runs
5 "	K Cyanate,	Irons badly hurt	
5 "	K Iodate	Nickel badly hurt.	
5 "	K Nitrobenzoate.	Iron badly hurt - Nickel OK	
5 "	Acetamide	20% loss	
5 "	Flour Sulphur	40% loss - too great an excess	
5 "	K Selenate	10% Loss	50 Run
5 "	Metastanate K	OK	"
5 "	Sulfosuccinate K	OK	"
5 "	K Succinate	OK	"
5 "	K Tellurate	20% loss	"
5 "	Hard rubber shavings	OK	"
5 "	Magnesium powder	OK	100
5 "	Cadmium "	OK	50
5 "	Lead "	OK	50
2 "	paper	OK	100
2 "	Na Sulphite	OK	150
4 "	"	OK	150
2 "	Na Sulphate	OK	150

(Experiments when we were using mostly CoBrCl flake shows that when Ni flake was used it was 10 to 15% lower capacity.)

(Damp $Ni(OH)_2$ makes heavy loading weight)

Selenium acts like sulphur

No question of conductivity comes in higher capacity due to more ions in pores to do the work.

500 mlg Sulphide Antimony . 25% loss capacity
" " Selenium. 60% loss " 100

With Tubes we use now

2 grms LiOH	27% KOH.		1360	50th run
"	25	+44	1316	"
"	23	+41	1275	"
"	21	54	1221	"
"	19	+9	1212	"
"	17	+29	1183	"
"	15	+23	1139 — Bad	"
"	13	—	1161	"
"	11	+32	1129	"
	9	+20	1109	"

1907 25% 54

1907 says this shows charging rate is bad, and Cobalt flake is much worse than Ni flake.

Iron is not active at low temps, requires like Carbon a certain heat when in a certain physical state to make it react rapidly. Only way out is to get more porous + finely divided iron + keep down Hg or abandon it, + increase disch rate for heavy work by increased surface —

A 5 gram Iron pocket giving 1480 to a volt Charged + dischgd Normal, 15 hours 400 Dischg 300 Same 7½ charged + dischgd hot 110 Fahr gave 2550 To a Volt, Why?

We never gave Caesium or Rubidium hydrate a good test.

Ni Tubes never plated always went bad on hot test, — See further on claiming this

Ni tubes run in saturated LiOH get a very red coating on tube cant be rubbed off. Ogna Regia takes it off in quick in transparent sheets having a reddish tint After 50 runs irons + grids bright, alloy Ellen different from Reg tubes, This is on discharge, but after 100 runs a brown red strongly adherent to tube This is 6059. Electrolyte being 21% KOH saturated with LiOH.
6059 is put in test tube with 100 cc water + 100 mlg HCl for several hours over asbestos

Possibly gelatinous Ferric colloid

on hot plate, in few minutes clinging red wipes off, dont think it dissolves but HCl dissolved off something that made it loose

Aluminum is bad in KOH NaOH, Worst of all,

3 grams of ferrous hydroxide put into Electrolyte 21KOH 2 LiOH 150 Runs actually increased the Capacity a little,

Why ?

→ Acetone is bad

NaBr seems to help Irons
300 Mlg Bromslone in Electrolyte 21K 2Li seems to increase capacity of the Irons
Can it correct passivity ?

Nitrates are bad either for Iron or Ni

Hydroxides the Fe + badly plated Tubes

Carbonates K dont hurt I even seems to help - when KOH, but hurts in NaOH when it Na Carbonate, 15% NaOH 2Li

Reg cells, 5 times normal boosts 6 months dont hurt in normal Electrolyte but hurts bad when weak ? why
Extra heat possibly

Must expand greatly in length.

We should Precip Ni by LiOH or see if Li is washed free or is there a Combination

Perhaps the gas which comes off on putting in acid is air in the pores

2% water

Many count
26.9 KOH

A saturated Solution of LiOH in water causes tube to be twisted cork screw like and bent.
$Ni(OH)_2$ must be an acid & Li forms a salt with it hence enormous swelling
June 1907

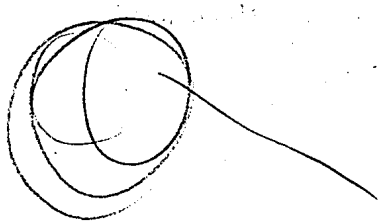
$Ni(OH)_2$ absorbs water from the air
There is always some NaOH left in it
also Carbonated —

Took 10 grms green from drum
Thru 20 times in - put on watch glass, in two hours on hot plate on a piece of paper lost 85 milg
in air gold regained 191 milg

Ni flake thru hydrogen is no good
must be elastic & not dead to make
Contact with walls of tube —

5 grams Lithium Chl 21 KOH better
than 21 K 2 LiOH.

Bismuth is not good except with LiOH.
only gives mg + — O W



This seems to show porosity is not
Enough in Ni dont get enough ions
to give capacity

Phosphate Lithia is inferior in KOH.

Evidently Li displaces Ba in the Electrolyte

Another Case where Phosphoric
Compounds are bad.

Phos bad
A Carbonate
with Li very deep from KOH

There are Cases where
Phosphorus does no harm

Green soaked in Titanium Sol 21K OK
" Zirconium " " OK
" Nitrate Didymium " OK
when LiOH put in it reduced capacity
Green baked in Hg Bichl increased " slightly
another piece further on says Bad,

Pure Ni Tubes. Ni rings Ni wire
100 Runs 1160, 1140, 1147 } 21% 1263, 1263, 1260 } 21 2 LiOH.

1360, 1353, 1353 } 25 2 LiOH. 1433, 1433, 1433 } 27 3 LiOH.

End Book No 4

Book 5 Soaked Green in Orthoplex LiOH precipitated
Potash then in Chl Ba — without
LiOH gave 987 with LiOH 2 470 —

Soaked KSO4 then Sr Cl — gave 1219 + with
2 LiOH. 1240 —

Antimoniate K + Ba Cl. 843 — with LiOH 1042
Conc Stannate Soda + Ba Cl. 1214 with LiOH. 1258

Nickel May be a compound
If so here is a method of seperating
the two, or something in $Ni(OH)_2$
that combines with LiOH,

It is remarked here that acid treatment of flake
removes Al_2O_3 & Fe.
Reg Ni along here with 2 LiOH was giving
1330 after 25 hot runs
End Book 5 #8000 group

Book 6 = #7450 group

Sr Carbonate precip in pores 300 Run 1133 - with LiOH 150 Run 965
Ba Carbonate " 300 Run 1080 " 150 Run 1038
Boiling green in Conc $HgCl_2$ + washing acet free
show large loss capacity after 150 Runs
Especially when LiOH is used -
without LiOH lost 70 in a h 150 run
with LiOH lost 250 - another Dup -
without LiOH, Lost 159 - with LiOH, 267 -
This is strange
Alcohol saturated with $HgCl_2$, + then
washed free much poorer capacity when
LiOH used -

Soaked green in Conc $Ni(OH)_2$ in Ammonia
+ NH_4Cl. boiled with KOH, washed well.
150 Run no loss capacity - it was Cut out 1150 -

No def when strontia used

KOH decomposes Chromium is known to make Irons go bad

Possibly closed pores so not enough ions to react,

Another case where phos combines to deal the Lithia in KOH. We shall have to test P_2 & water for phosphates —

+ washed free NH_4Cl —

Bismuth — 10 min soak 1/2 strength Conc $BiCl_3$ NH_4Cl left all night 10% KOH. Then boiled + washed free Cl.

6.41 wt —

Cold	50	150	200	Co
1033	1120	1120	1077	
1155	1450	1239	1176 —	1000 1290 — LiOH in this

Another with Bi made nearly same went to 1367 on 100 + then bad —
Another where tubes soaked went from 1130 to 1380 on 100 + then went bad - 990 —

(Green soaked $BaCl$ K_2SO_4 — No LiOH, better than with LiOH —

Soaked $BaCl$ + Chromate K — Irons go bad —

Soaked Green in $KMnO_4$ + $BaCl$, only gave 580 @ 640 - Cold — bad —

Orthophos K + $BaCl$ — no Li 50 Run 990 but with LiOH 467 — Note bad effect of phosph on LiOH. [illegible]

We were oxdzg flake at this time —

Evidently Li dont combine or displace CO_2 from Lime,

not oxidized now —
Another Case where phos in green effected the LiOH & it went bad

8731 group RA 1072 at end 200 Runs
200 higher than the Dup in LiOH —

When mg CO_3 & others are precip in pores of green the LiOH drops are much worse than Reg 21 KOH, with phos lime capacity about same KF & CaCl same capacity

Green soaked in Conc $BiCl_3$ in Acetone
LiOH — which seems necessary for Bi
Cal) 25 50 100 150 200
" 1062 1380 1394 1360 1347 1280

Bismuth 5
Little Mercury precipitated in the pores
No LiOH. 150 Run 1106 — with LiOH. 1335.
350th Run 1237 1087 } 400 - 997 990 } put in new 7s
1230 1287. 500th Run 1219 1297 } -

Where Bi in this

Examine this in book

5 grm irons — Def % Hg. Highest
50 Hot Runs

	750 rate	300 Rate
2% Hg	425	1545
3%	1037	1720
4%	962	1665
5%	850	1610
6%	987	1630
7%	837	1600
8%	900	1560
9%	962	1600
10%	950	1560

Last % of Hg

~~See Iron book worked on Copper for connection —~~

~~250th run~~	~~750 rate~~	~~300 rate~~
~~2~~	~~1495~~	~~795~~
~~3~~	~~280~~	~~1100~~
~~4~~	~~212~~	~~1065~~
~~5~~	~~612~~	~~1100~~
~~6~~	~~462~~	~~1075~~
~~7~~	~~406~~	~~1070~~
~~8~~	~~542~~	~~1005~~
~~9~~	~~375~~	~~1005~~
~~10~~	~~480~~	~~922~~

N. flake treated with $BiCl_3$ NH_4Cl reduced Bi on flake, steel Color, washed with Ammonia Chloride

#478	Cold	100	200	250	350	500
	1220	1420	1480	1420	1520	1270

650 changed Fe did no good — 1263, 1200, 1417

Tried almost every organic in the KOH,
Cresol Bad Very
Trichlorophenol Bad
Salicylic acid Bad
Picric acid Bad
Resorcin Bad
Methyl Alcohol Bad
Formaldehyde Bad
Benzidine —
Hg Salts of These Sol in KOH & Li

#571 — 1.8 Bi —	50	150	300	400	550
	1430	1440	1450	1260	1340

600 + new Fe 650 700
1490 1570 1557 —

Noted that after a long run without LiOH. if irons are changed it goes bad whereas if Bi is present + Li I remark that new Fe gives out something that hurts tube

LiOH Bi flake

Phosphotungstic Acid —
Electrolyte gives high hot runs
1363 to V 1510 1/2 Volt + 1453 Hot — NOTE

Phosphomolybdate K High hot
2 + 4 grms — but only
give 387 to Volt Cond + 1003 hot

2 Phos Molybdate — no LiOH
367 60, Ref 387 Hot.

Antimonate K. 600 } 1 Volt 50 cc Ferro
+ 1190 to V Hot 897 } 2 LiOH.

Bi flake —

Another Dup # 1684 2 grms
Phosphotungstate K — 1373 to V 1267
2 Li

Note this, It was Antimony in Fe
that gave such abnormal high
Capacity but very capricious
Its a reagent for K & Chink

In 2 cases with Ref Bi tubes running
550 times hot 1/2 V was 1640 + 1 V. 1230
but when Fe changed 1 V was 1440 +
1/2 V 1550.

I note that low LiOH is best for
Bismuth for a long run — #1172
But mark it Doubtful, Hopper Made
Mistake —

Acetanilide Very bad 50 runs
Picric acid " "
Dinitrotoluol " "
Triacetylhydroquinone Bad " Benzoylacetone Bad

" Sulphomolybdate K 50 Run Zero

#1948 to here Book 10

Get the Fe books

Make Notes —

Especially Antimony

Iron

In Book 13 notice, good effect of changing iron.

200th Run	changed iron on	250th Run
1270		1413
1283		1540
1263		1473
on even 400th Run was		1293
		1267
		1300 —

This shows or appears to show we dont have enough iron

With 36 mlg green to 4.2 flake

200th Run		Changed Fe 250 Run
	1330	1437
	1223	1433
	1330	1433

With 48 green + 4.5 flake to dump

200th Run —	Changed Fe 250 Run
1390	1463
1320	1480
1420	1477

But there were 3 cases where changing Iron didnt do any good on same pages —

#579 16.8% Bi Run first ~~21K4Li 1/4 rate~~
Li OH, then 21K2Li

50	100	150	200	250	300	350
1446	1430	1446	1305	1447	1492	1337
400	450	500	550	600	650	700
1365	1443	1506	1356	1493	1525	1556

Smaller chgd & dischgd twice in 21K8LiOH 1/4 rate then changed to 21K2Li at 700th Run gave 1536 ——

I note this - Changing from improves Bismuth tubes on 1st 2nd & 3rd runs & that run capacity which falls 33% on 1st Charge comes back — This is not so with Non Bismuth — they improve on 1st run & then they grow bad as of iron gave out something bad.

Or doesn't build up after original Hydrogen made iron is oxidized

Isn't it phosphorous or Al or Y unknown
Isn't it unknown iron
Iron aluminum

A soaked Bi green grove 1314 50th run then run along ~~gave~~ this

100	150	350	450	500	550	
1250	1380	1450	1230	1250	1010	?
Changed 72		600	650			
		1170	1335			

Guess loading wt changes & its liable burst tube from water lubricating & making dense & too much load wt –

Green mixed with Oxide Bismuth 10%

Cold	50	100	150	250
1083	1450	1440	1533	1587

350	450
1615	1550

remarked 1164 too heavy

Book 14

Exposing green for 2 weeks did no harm –

~~but the loading~~

Connected 2 grams Tri to each tube –
ditto 2 grms B 2 Tri
ditto " Pb & 2 Bi
ditto " arsenic only
Did neither good or Bad

Cd alone

Tube filled within 1/8" of each end, the ends filled Carb Soda went bad only 967 milliamp burn – flake & green got chance to expand & get act contact.

Dried alumina seems to do not harm but undried precipitated alumina precipitated in Electrolytes is very Bad –

This seems true for Silica

Drying changes both & makes them inert, non colloids

Probably true of Fe Ar & Ti its only when not dried they are bad.

Because dried

Silica precip in green 2/10 lb. did no harm even 1% no harm
Neither did 1% alumina but guess it decolored out, or dried

1/2% Co precip in green showed improvement,
1% decided improvement, 350 mm
1410 –
2 grams Silicon connected
Each tube went bad only 1780

Bi + Si dittos.

Cr 2 gms went a little bad

Vanadium is Bad for cells

Neither Fe or Chrome precip in green in small quantity is bad – or Ti

1164 green is heavy green —
Mixed 20% Anhydrous B_2 with it

Cold	50	100	150	250
1260	1530	1720	1747	1555 Co —

Burst 3 places —

30% B_2O_3 only dedut do as well
50% " " Much worse

Another 20% B_2O only 500 Run 1415
it showed with a 30% B_2O only
1887 to 1/2 volt after 200 Run
but only 1267 to .9 — 72 Good 9
guess

Effect of dissolving Metallic Aluminum

	100 Run
1 Milgm —	1230
3 "	1230
9 "	1232
27 "	1125
81 "	1062

20 Milg — 175 cc
21% NH_4Zn —
appears OK

This apparently Bi_2O_3 does not conduct as $Ni(OH)_2$ alone without flake gives 200 Matt —
What does it do

Green mixed with 16.8 Bi put in tube
without flake
50th Run 103 Mah

2 grms Tellurium Connected
Each tube, not good —

ditto 7% Va alloy — Very bad 610

734 green 16.8 Bi — 1st 2 ch & dis
in 8% LiOH, 1/4 rate. then changed
to 21K 2Li —

500 Run	800 run	1050 run
1487	1524	1577
1250	1300	Bad Cent.
1423	1333	

another one charged & dis
twice in 4% LiOH rate then
put in 21K 2Li goes
about the same

5.145 | 7600 | 1477

5.145

1477

5641 | 7600 | 1347

1073 | 5521

5641

1123 | 6333

1195 | 6445

5351

1107 | 5902

1157 | 6399

600th Run Highest tube only

		5.145 mg ±.1 Mah		weight Mg
2 lb 02 light lamp	1477		1073	5521
2½		5.351	1103	5902
3			1050	6027
4	1347	5.641	1123	6333
4½		5.510	1157	6399
5		5.390	1193	6.445

2 lb not quite enough
Capacity for grams
Insufficient

End book 15

filing down burrs
walking on it
Lime Carb mixed in green
in powdered form does not
harm – used powdered
Marble

It certainly is curious, we have much to learn about the iron

Possibly Ni plating is not good see 3 pages ahead where iron plated iron gives good results.

Perhaps Ni has some bad action on Hg
try iron plated tube without flake —
wait with & without Hg
(catalytic)

Celluloid dissolves in KOH.

Iron pipe in tubes 10 grms
only gave 2100 max
flake — no

with flake went to 250
max on 200th run continuous
without flake 1230 —

This is Curious

Bi dont work without KOH.
100th Run

No Li —	933
1% Li	1380
2%	1533

Took piece film Celluloid
folded it in tube & loaded it

Didnt do any harm 950 start
1000 on 250th Run

This goes to show that Bi dissolves in KOH + is reduced by the iron, or lowers its voltage so it cant reduce the nickel but when heated its voltage is increased or the Bi is oxdized + no longer interferes

Tantalium is now known to act as a Valve like Al in rectifier + more strongly —

Bi in NaOH + various LiOH not near as good as KOH,

5 gram Cooke Reg Fe without Hg — But with

	Cold	100 Rum	Hot
5% Bi in Fe	590	45	1510
10 %	1175	85	1260
15 %	2130	85	1260

Note

Tantalum Bad — wire 1 gram Connected to Lube

2 gms Alum Metal Connected to Lube Gold 1093 — 50 Rum no Capacity at all

This must effect the iron

NO_3 Oxdy Fe_2 & then forms an inactive hydrate probably?

It may be that Ni acts catalytically in KOH & is bad both for Ni tubes & Iron tubes — Iron tubes pockets and grids only the poles plated

Have got rid of nickel goes bad iron seems OK

It may form iodate film or Combination with $Ni(OH)_2$

Schumerka finds what Jahn does

Here soluble Si Can act

20% Bi tubes —

2 grms K Nitrate in Cell

Very Bad 587 on 50th Run bad

gave 1623 to 1/2 volt,

2 grms Na Nitrate only 400 to g.

+ 1683 to 1/2 volt,

Illumin. Na hunts some

Reg Ni Reg tubes Not plated

gives 1258 300 Run 1190 500 Run

600 run 1073 — see note back

2 grms Iodide K —

Bi tube — gives no chg or discharge

Bi tube 2 grms Na Silicate

50th 1355 100th only 120

130 to 1/2 + 1250 hot.

7.613/150%

1850
1200
3750
18 750
22 250

1750
1400
3600
1700
3000

1750
1250
3400
1900
2500

should have been run longer on board

Sulphate Lime in cake no harm

25% Cobalt precip in Green

Cold	50	100	150	200
927	1370	1507	1467	1460

300	450
1360	1313 — burnt 1 plumbum

Wt 7613

30% Co 150 Run Cut out — 1393 -

50% Co 1290 - Cut out

Another 30% Co — 300 Run 1367
Note says of this hard Green
run on Grand Reversal
time coming have Green
very high —

25% Cobalt.

Cold	50	150	300
1083	1490	1400	1357

500
1193 —

Arsenic probably reduced to metal

This not run as long as 4 yr old 7/2 below – but three yr gives 1050 to V in many cases

Proves $H_2(OH)_2$ dont go bad its colloids destroying contacts

Later Aug 1 1914 Cut open 1/2 of 1/2 old tubes 4 yrs that gone down bad – Tried flake contacts in test machine found that 85% of flake sections were in contact Evidently Ni itself goes bad, colloids or dehydration, or combination with some acid

Arsenic bad in Bi tubes – (1e)
Arsenate Na in Electrolyte

Mix taken from old 927 + 928 tubes – tubes washed free of KOH. dried ~~807~~ 8358 taken out all flakes except perhaps 15% removed – Mix treated with weak H_2SO_4 – then washed + dried.

Book 16 – 4443 –

Cold	50	100	150	200
1380	1293	1282	1327	1383
250	300	400	500	
1385	1417	1393	1350	
550	600	750		
1327	1153	1073		

Perhaps 7/2 went bad or might have run longer

Hydrofluosilicic acid precipitates Potassium as potassium Silicofluoride Insol. — Perchloric acid precips K

Acid Metaantimonate of Potassium gives white precip of Sodium Metaantimonate —
Li, NH. + Earth metals does same thing —

There is no doubt but that when H is given off iron on change, that if the Ni & Fe plates are too close we get H_2O_2 & then we would reach a limit to the change of the iron perhaps thick packets by poor circulation preserves most of the Fe from reoxidizing by H_2O_2 formed — it would be interesting to put paper between plates to stop oxygen going with Fe packet

I had a Chemist (sic!) test for H_2O_2 but he couldn't find any —

test Electrolyte of Chg
Cell for H_2O_2

To make $Ni(OH)_2$ more porous
precipitate $NiSO_4$ / Manganous SO_4 } by NaOH
then wash & dry put in tubes
put plates in 21% KOH or NaOH
& oxidize to Manganic & wash
out as Manganate K

ditto $NiSO_4$ — $CrSO_4$
" $NiSO_4$ — Stannous SO_4 —

Potassium Biniodate
Insol water — sol very
dilute acids — Thus if
what possibly makes
Ni go bad

Potassium Hippurate insol cold
sol Hot water,

Potassium Iso-purpurate V slightly
sol water — Explodes dangerously
at 210 C — H_2SO_4 Explodes it
its K Picro-cyanate,

Potassium Nitranilate only sol
Hot water — Explodes violently
on heating

K Perbromate only slightly
sol water

Ditto K Perchlorate slightly
sol water

K-periodate, v slightly sol water

K perruthenate slightly sol water

K Pertungstate slightly sol water

K Phosphite only sol Hot water

K Phtalimide only slightly sol water

K Piperate, only sol Hot water

K Pyrosulphite only slightly sol water

K Silicofluoride - only sol in Hot water

K Sozo-iodolate, (K Di iodo-para-phenol sulphonate) slightly sol water

K Urate, Very slightly sol water

Lithia Borate, V slightly sol H_2O
" fluoride " " "
" phosphate Insol water

Think Fe_2O_3 from fusing anhydrous Sulfate iron in NaOH & Sulphate Soda, will give a good capacity at lower temp than Fe_2 now ~~Matter~~ Made — its very fine — & possibly it will be best without Menamy as that leads to Crystalizing & make it Coarser — Old Weber & Smith test Reg iron without Hg for effect of Cold

Cells with weak KOH, Can be reduced by passing Sulphurous acid — goes rapidly — product K_2SO_4 My old cell thus & wash out K_2SO_4 —

Old iron from 4 yr Cells if washed with 3% Sulphurous acid — & ground thru 150 mesh is nearly as good as new, Apparently wants a reducing agent,

Strange thing is that iron looks black when taken out of SO_2 acid if washed & dried is a dirty red all thru & yet runs good —

Strange!

Charge cold Ni + Fe OK
" Hot Ni + Fe Bad
Dischg Cold Ni OK Fe Bad
" Hot Ni OK Fe OK

OK Bad

The great problem is to equalize these two opposite effects, because in the Cell one works against the other

We know that Bi in $Ni(OH)_2$ causes it to give 2½ times Reg doses on hot discharge, Does oxidation of Bi give local heat enough to cause $Ni(OH)_2$ to be easily oxdzd while Electrolyte is cold, Cobalt would also, this may be the Explanation

Nickel tube on charging hot + dischg hot gives only 1/3 the Reg temperature Charge + dischg Capacity. 400 @ 50° when gives 1350 chgd + dischg Normal temp — its not the iron as that gives high capacity on hot discharge.

Find from Smith about Capacities
Chgd hot dischgd Cold
" Cold " Hot for Ni + Fe
Want these Curves —

We found that iron gives greatest Capacity Reduced Cold Oxidized hot

Nickel. Oxidized Cold reduced Hot
is the above OK see Smith

Nickel tube chgd Cold holds its Chg in hot 130 + gives full reg Capacity therefore when $Ni(OH)_3$ is formed its stable but when Electrolyte hot its hard to Oxidize —

Is this Correct

Possibly both iron & Ni should be
both on chg Cell be in cold
Electrolyte & But on discharge
its certain iron should have
heat as its dead at 40 degs

But the Ni is also effected &
Smith must find if its
Dry hot or cold that causes
loss Capacity –

Its probable Ni wants to be
Chgd + discharged Cold
While Fe wants just the Opposite

Aug 1 1914 – Iron in new Ott #4 dia
only crimped around Edge, gives
2700 Regular – gives 1900 at 350
deg –

Jany 1 1914

Important to work on getting Iron finer in cell

This will increase watt efficiency — & also act at lower temperature

Have to make a larger batch of Iron Ox from fused Na_2SO_4 + NaOH, in which anhydrous $FeSO_4$ is dropped using slight excess NaOH. This is practically colloidal. See if product could work without being reduced by Hydrogen if not reduce at lowest possible temp by H ~

Jany 1st 1916

Made a lot of tests but in the end they were no improvement

9/10 of Volt —

	Cold	50	½	Hot	100	½	Hot	150	½
2294	1210	1380	1417	387	1447	1497	507	1480	1540
2295	1200	1383	1423	377	1440	1493	473	1463	1503
2296	1210	1390	1427	333	1467	1520	520	1510	1573
2297	1213	1417	1440	327	1460	1500	477	1460	1490
2298	1220	1440	1460	387	1530	1567	547	1520	1553
2299	1213	1417	1443	347	1463	1507	503	1493	1523
		1424	1435	361	1468	1514	521	1488	1530

Hot	200	½	Hot
863	1367	1483	690
797	1353	1403	640
813	1413	1550	694
667	1363	1477	600
657	1420	1497	580
673	1407	1457	580
744			

CO =

1164 RA green Loads reg way
8.2 – This is NO 1253 RA a dup of 1164
These tubes load 7.650 – 7038 green
#159 flake 4 flake 47.6 green
Dump green then flake. Then Tamp
162 tamps

Book 11 =

The higher the hot discharge the older is the Nickel but on board gets lower

Evidently the Nickel takes a higher Charge when hot after it gets old but at same time its Cold charge gets weaker —

Book 11 2501 — Case where Fe changed after run on board & rerun right away — loses 145 mah Capacity. as if iron poisoned it or elsc new iron was in peculiar Condition, passing off fresh Hg & this form Hg scum on Nickel —

(It may be Hg is a bad thing

(As Oxidation of Hg in alkali makes a tenacious film + an insulator

May be Iron itself goes down after few runs test iron do it

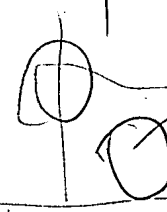
·9 V

		50	½	Hot
2501	1243	1283	1337	550
2502	1250	1323	1373	447
		100	½	Hot
		1283	1343	430
		1307	1370	403
New Fe treated by reversing put in + rerun				
		1127	1253	533
		1173	1277	577
		150	½	Hot
		1120	1177	617
		1147	1200	573
	#	350	½	H
		1050	1093	580
		1090	1167	613

Tube made with flake Copper plated – gave about Reg Capacity 50th Run #11 book 2641-2

Zinc plated ditto –

	Cold	50	1/2	Hot
1.V. Iron plated	823 807	727 730	733 737	320 387
1 V- Cobalt plated	1233 1207	1240 1270	1283 1297	431 413
1.V- Cadmium plated	1170 1160	1193 1163	1217 1190	450 373
1.V. Lead plated	1210 1193	1260 1247	1295 1280	420 364
1.V. Antimony plated	967 987	1293 1330	1328 1350	567 560
		100	1/2	Hot
		1307 1273	1327 1300	—
		150	1/2	Hot
		1317 1300	1350 1320	827 807



note S.

Note Antimony – if put in solution low capacity to 1 volt But if Antimony plated on Tube the 1 volt Capacity is ok & has the curious hot high Capacity –

21K2 Li 2 K Antimonate.

	Cold	50	1/2	Hot	100	1/2	Hot
#1720	1207	573	1347	1137	590	1403	933
21	1187	610	1490	833	620	1407	990
22	1183	573	1407	1030	567	1413	830

Book #9 –

4 K Antimoniate

Cold	50	1/2	Hot
1167	573	1237	973
1173	600	1457	780
1180	573	1390	1067

S

very high

21K No Lithia – 2 K Antimoniate

Cold	50	1/2	Hot
1147	697	1097	623
1127	1107	1173	377
1143	767	1130	623

21K No Li 4 K Antimoniate

Cold	50	1/2	Hot
1153	797	1163	577
1153	940	1163	520
1150	607	967	777

Be sure get Lithia Good giving Antimony Grow high results

21 K 2 Li — 2 K Antimonate

	Cold	50	½	Hot
1791	1283	593	1530	940
1792	1273	633	1593	1083

This is Dup of 1777 which has Bismuth flake —

Reg 21 K 2 Li - 2 grms Antimony Connected to Each Cube —

Cold	50	½	H	100	½	H
1240	1323	1330	303	1267	1283	571
1233	1257	1270	170	1203	1217	560

150	½	H
1267	1283	740
1243	1253	647

$Ni(OH)_2$ Goldsbrow 448

½% Iron precipitated in green.

	V	½	H
200 th Run	1333	1347	497
	1310	1320	470

1% Fe in Goldsbrow 449

150 Run	1197	1217	407
	1123	1130	323

B_1 flake made with $B_{12}O_3$ 1625 cc
NH_4Cl See Book 10 #1750-1-2
flake weakened, tears by stirring
showing large part Ni flake
replaced by B_1 292 Dump 7.720

50	1/2	Hot	100	1/2	Hot
1290	1467	1527	1087	1477	1610	1087
1293	1457	1517	1080	1477	1607	1060
1283	1460	1533	1007	1500	1630	1117

150	1/2	Hot
1313	1440	1180
1333	1473	1287
1327	1460	1303

Note high hot.

What is it

RA 1164 8.2 green -25 lb lot.

4.2 flake 24.1 green—dump green then flake
then lamp 8.105 —green itself 6.871

Cold	50	1/2	H	100	1/2	Hot
1097	1210.	1273	247	1287	1350	320
1080	1267	1320	240	1363	1420	370
1077	1197	1307	243	1300	1390	387
	1225	1300	243	1316		

150	1/2	Hot	200	1/2	Hot
1277	1380	400	1270	1450	527
1357	1467	423	1287	1543	523
1300	1420	377	1263	1473	520

Changed Iron

250	1/2	H	300	1/2	Hot
1413	1453	533	1330	1397	580
1540	1580	627	1390	1477	597
1473	1523	577	1383	1443	627

350	1/2	Hot
1283	1367	570
1260	1380	590
1323	1413	600

Not split

or Rings broken

This shows great swelling Capacity of Nickel hydroxide, less the flake more the swell being more green

Split - 3 rings broken

4 flake - 36 green to dump

7.800 6.934 green

Cold	50	1/2	Hot	100	1/2	Hot
1113	1350	1373	267	1443	1477	433
1087	1270	1313	267	1357	1430	453
1103	1310	1353	270	1433	1480	553

150	1/2	Hot	200	1/2	Hot
1393	1477	400	1330	1533	517
1313	1420	383	1223	1477	497
1387	1450	423	1330	1497	433

Changed Iron

250	1/2	Hot	300	1/2	Hot
1437	1500	587	1230 X	1323	707
1433	1507	567	1123 X	1247	710
1433	1493	553	1200	1330	690

Co

48 green 4 flake -

Split - 3 Rings broken

Cold	50	1/2	Hot	100	1/2	H
1117	1350	1383	320	1477	1510	593
1080	1260	1313	300	1393	1457	580
1117	1337	1360	293	1460	1500	697

150	1/2	Hot	200	1/2	Hot
1440	1493	483	1390	1543	477
1327	1443	420	1320	1483	410
1450	1507	500	1420	1550	487

Changed Irons

250	1/2	Hot	300	1/2	Hot
1460	1527		1230	1323	707
1400	1460		1123 X	1247	710
1477	1507		1200	1330	690

Co

Book 10 – 2090 tubes

60 green 4.4f 7.573

average of 6 tubes 7.058 green

Cold	50	1/2	Hot	100	1/2	Hot
1115	1328	1353	603	1382	1430	455

150			200	1/2	Hot
1354	1416	590	1342	1383	506

Chgd Fe

250			300	1/2	Hot
1229	1319	582	1177	1270	593

Average 6 72 green 4.4f 1164 green

Cold	50	1/2	Hot	100	1/2	H	250		
1076	1298	1325	730	1361	1406	421	1288	1341	488

Nothing beyond this –

~~Thank previous books have~~ more –

~~Book 22~~

Reg. tube 21K 2 Li –

2 grms phosphotungstic Acid in KOH.

Cold	50	1/2	H	100	1/2	Hot
1183	1353	1530	883	1270	1567	1068
1180	1350	1575	973	1363	1510	1153

Co

Note high hot

KOH 21% 2 Li –

Book 10

Phospho Tungstate K 250 Milg – # 2015-16-17

Cold	50	1/2	H	100	1/2	H
1197	1313	1377	660	1290	1430	693
1197	1287	1347	510	1287	1407	643
1210	1357	1357	533	1300	1420	690

500 Milg Phosphotungstate 2018-19-20

Cold	50	1/2	H	100	1/2	H
1190	1283	1350	540	1273	1410	703
1190	1283	1347	583	1243	1440	633
1187	1287	1357	647	1273	1440	633

Co

750 Milg PWo – 2021-2-3

Cold	50	1/2	H	100	1/2	H
1220	1313	1410	757	1237	1490	740
1210	1313	1383	723	1287	1470	723
1207	1313	1383	750	1273	1480	823

Co

Book 10

1 gram Phosphotungstate K 2024-5-6

Cold	50	1/2	H	100	1/2	Hot
1207	1313	1463	753	1287	1487	830
1220	1290	1413	917	1280	1500	817
1210	1287	1387	627	1220	1473	800

1/2 grms Phosphotungstate

Cold	50	1/2	Hot	100	1/2	Hot
1213	1323	1450	587	1120	1623	863
1193	1290	1433	587	1100	1617	783
1207	1290	1440	817	1170	1580	840

High

Note 100th Run To 1/2 v

There is something in this phosphotungstate of K - try 2 2½ 3 & 4 grams to a test cell -

Try Borotungstate of K

Phos tungstic acid acting on 4 yr (black ~~[illegible]~~) s makes lots Collors in Wash water

None with Phos Molybdate

Lot of Regs with different flakes when we were Ordg & Experimenting

Book 8

9660-1
9661

750 Run Chgd Fe

700	1/2	Hot	750	1/2	Hot
960	1350	707	940	1217	720
1027	1373	673	1047	1350	700

Changed Fe

800	1/2	Hot
750	1077	660
897	1233	680

Co

Fe - Not changed

9662
9663

700	1/2	H	750	1/2	H	800	1/2	H
1240	1567	740	1080	1437	750	900	1350	663
1110	1433	647	1133	1440	700	1000	1313	637

Co

9871-2

700	1/2	H	750	1/2	H	800		
1067	1407	627	1213	1413	676	1123	1257	747
1063	1297	520	1133	1243	573	1083	1263	747

Changed Fe

850	1/2	H.
1050	1107	700
1037	1097	733

Co.

There are Several More at same place in book 8

Book 8

723 green-sheared flake made as now

24 green 3 mlg flake each dump

Cold	50	100	150	200	250	300	350	400
1240	1313	1400	1400	1437	1400	1400	1357	1303
1233	1300	1363	1363	1410	1380	1390	1363	1340

2 Mlg flake each dump

Cold	50	100	150	200	250	300	350	400
1257	1350	1400	1363	1433	1390	1403	1350	1303
1260	1350	1410	1460	1433	1400	1397	1317	1313

9 remark that changing irons seems to

Changed F_2

450	500	550	600	650	700
1200	1223	1083	1220	967	887
1333	1327	1220	1330	1057	947

CF_2

450	500	550	600	650	700
1227	1193	1090	1217	887	807
1223	1223	1003	943	573	790

hurt, but if Bi is used it improves capacity

Soaking old bad tubes.

Only ones gained is

Conc Potassium Benzoate	34 mah
Strong Zn Chloride	66
NH4 Cl. strong	120
Na Nitrite - strong	147
Zn Sulphate "	140
K Chlorate	50

Arsenate Na 1 tube lost 200 other gained 200

Nitrate Ammonia brightened up Everything
Neither gained or lost,

Book 22 - Think previous Books have more -

Following Materials put in tubes with flake Reg way Cut no Nickel Mixed - 21 K 2 L.

		Cold	50	1/2	Hot
6.700	Cerium hydrox	20	0	0	10
6.500	Nickel Molybdate	265	0	0	310
9.5	Barium Chromate	10	0	0	10
8.5	Strontia "	0	0	0	0
6.200	Calcium "	33	0	0	72
8.5	Cadmium "	33	0	0	39
7.7	Cerium Molybdate	1	0	0	7
6.7	Iron Chromate	1.7	0	0	2
6.000	Ni "	570	487	520	425
6.5	Cobalt "	145	120	120	307
4.5	Magnesia Oxalate	0	0	0	0
10.400	$CaWO_3$	0	0	0	0
15.350	Hg Chromate	1093	70	108	72
10.700	Strontia Tungstate	13	30	37	23
7.100	" Fluoride	8	30	37	23

~~My Experiment of soaking green in diferent strengtths of Cobalt sulphate~~

160

1326 1742 411

My Expts soaking Cobalt Sulphate in Green — Solutions containing the percent of solid $CoSO_4$

	50	1/2	H	100	1/2	H	150
3%	1328	1342	473	1271	1411	508	1331
5%	1308	1323	502	1261	1383	522	1313
7%	1329	1344	482	1259	1413	527	1369
10	1313	1329	454	1252	1396	548	1341
15%	1288	1307	508	1239	1392	575	1342
20%	1298	1327	531	1322	1428	559	1332
25%	1361	1380	560	1398	1437	612	1429
35%	1378	1396	623	1365	1421	633	1420

Reg Green 1% Uranous hydroxide — Δ Wt 7.480

Cold	50	1/2	H	100	1/2	H	150
1150	1363	1387	533	1427	1453	707	1481
1123	1300	1313	533	1330	1377	707	1347
1160	1363	1387	643	1410	1430	825	1457

Loading Wt 7.480

Uranous

Important to Experiment with this

Δ Wt

3%	7.193	20%	7.220
5	7.193	25	7.202
7	7.136	35	7.170
10	7.175		
15	7.188		

1/2	H	200	1/2	H	250	1/2	H	300	1/2	H
1435	580	1144	1308	674	CO					
1388	559	1175	1348	644	CO					
1443	570	1151	1323	604	CO					
1404	565	1207	1466	638	1156	1324	633	1066	1275	577
1415	650	1391	—	723	1271	1416	606	1209	1385	725
1408	678	1329	—	677	1322	1440	732	1226	1378	—
1481	833	1421	—	681	1397	1515	705	1352	1469	764
1473	849	1404	—	757	1377	1491	658	1349	1469	761

Experiment

broadcast swellers

1/2	H	200	1/2	H	250	1/2	H	300	1/2	H
1487	765	1447	1527	767	1430	1557	767	1397	1483	750
1387	680	1380	1453	723	1380	1480	733	1393	1477	567
1483	723	1417	1483	790	1430	1483	687	1323	1397	707

Uranous hyd probably oxidizes to Uranic Oxide which combines with NH_3 to form N_2 Uranate which is absolutely insol in KOH & Cement, Mix like Bi carbonate & holds contacts

	350	1/2	H	400	1/2	H
10%	1148	1343	—			
15						
20						
25%	1077	1338	662	1237	1412	
35	1122	1360	704	1269	1488 Co	

7 Runs

Note 1 25% after run when 1480 to volt.

Swollen bent, split 4 plates

bad bent, swollen, split 3 plates

1/0 Ur

350	1/2	H	400	1/2	H
1267	1407	850	1057	1323	733
1267	1410	857	1150	1400	757
1163	1263	793	1023	1200	737

250th run over on board

Went To

	1/2
1523	1573
1473	1557
1467	1510

Uranous

Something in Uranium

Big cells do not get these results even run ordinary temperature

The Uranium 1/0 Dieps No 7654 book 22 =

One tube got to 1567 1610

on 400th Run 1360 1527

The Boro is — Cost 213 MAH per Gram

best B, 232 " "

Reg green soaked 48 hours in Conc Cobalt Chloride — 7055 weight

Highest tube taken

50	100	150	200	250	270 Run over
1287	1393	1467	1480	1453	1503

bad split

300	350	450	500	550
1463	1483	1467	1320	1297

600	650	700
1490	1440	1153

shorted here. Changed from 87 run where on board

up to 600 both Tubes. about same then on bad split — 860 Hot.

For full runs on Fe def % of Hg see Fe book marked X on Cover

Tubes not plated - but annealed
Wt 7.000 — 21K2 Li 1256 grams

50	100	200	250	300
1260	1288	1355	1250	1275

350	400
1030	

Na OH. preap with only Theoretical amount of NaOH.

50	100	
1210.	1237	Co

Goldstein 659 - 1% Co - Na OH, 7.230 wt

50	100	150	200	250	300
1406 -	1450	1445	1396	1340	1196

350	400
1270	1100

3% Co - 209 mah per gram test 6.830 wt

50	100	150	200	250	300
1412	1432	1373	1250	1200	1150

350	400
1120	1040

4% Co 6.900 wt

50	100	150	200	250
1420	1405	1360	1275	1150

300	350	- Co
1120	1140	

5% no Gellie Leone 6.680, wt, Rhodes hard charged Iron also run on board charged

7117 - Goldalem 621 12% Bi

Can not plated inside - Nickel tube Connected to Can

Highest tube

50	100	150	200	250	300
1635	1710	1533	1570	1533	1640

350	400	450	500
1417	1033	1063	1153

Kept Turned off Later

Iron Connected to Can

50	100	150	200	250	300	350
1467	1443	1400	1203	1383	1380	1253

400	450	500
1300	1187	557

Abrogast Co 1% Best tube

50	100	150	200	250	300
1395	1410	1423	1390	1407	1347

350	400	450	500
1200	1100	1143	1053

Nickel tubes not plated
Can't be used with Bismuth
Goldalem 621 12% Bi Best tube

50	100	150	200
1610	1180	867	657

Seal

Showed Iron OK

This is a Clue ?

Try pure Ni

5% Erbium hydrox precip on Ni OH-

Cold	50	1/2	Hot
1063	980	993	720

Not Hot

5724 Dry NaOH Ni SO4 on Balls
7566, 101 & probably prepare it on bulbous

400 Run best	450	700	750
1533	1433	1123	1150

Split upon sweep

Something wrong

Green & flake from cells 1690 To 1695 after running 600 times removed treated well glycerine + KOH. to reduce — floated off flake & treated it with 2% H_2SO_4 — green washed free of glycerine + momentarily dipped in 2% H_2SO_4 —
Reloaded 27 grain .0083 flake
215 Dumps 7560 lot

Cold	50	½	H	100	½	Hot
1513	1487	1523	967	1350	1460	993
1507	1480	1527	970	1387	1513	1027

150	½	H	200	½	H
1320	1433	977	1167	1280	950
1320	1440	1008	1170	1267	953

250	½	H	300	½	H
1267	1367	863	937	1020	847
1297	1390	860	1073	1183	890

Reg short (old tubes) soaked 6 tubes — soaked in gallon 21% KOH for a week gave not a trace of LiOH in the gallon Anything of tubes gave 700 mlg of LiOH + 1800 mlg KOH per tube — on long tube this is 1 gram LiOH that always in tube of kept in 21% KOH.

Lt must combine

Holland: test of big cell in water changed from time to time showed LiOH. Kept coming out after KOH was practically all removed H2 has record —

The LiOH combs stable in 21% KOH but decomposes in water

Take 100 of our Rubber Separators
5 or 6 Cells & treat
1st HCl —
2 Acetone
3 Benzol
4 Hydrochloric
5 Alcoholic KOH 21% 2 Li hot,
6 Chloroform
Evaporate liquor of
Each lot to see what
residue —

Try 2 test cells, (the Electrolyte Saturated
Li OH & 10% of —
Carbonate Potash

Attended to

Attended to

The Material from 4
Returned Adams Ex
Cells 100 amp hours
taken out by
Smith is in
Christensen hands
Experiment on it

Goldstein Book 19 =

Dry Ni SO4 & Dry NaOH. mixed in Rolls
washed & dried at 130 Fahr – 7566–7473

Cold	50	100	200	300	400	700	½	1
1217	1360	1460	1447	1450	1533	1123	1417	627
1246	1360	1483	1483	1400	1390	1013	1267	597

had been pressed in Cakes ½" thick 300 atmospheres
ditto

Dried 16d – 7318–7308

Cold	50	100	200	300	
1227	1360	1467	1437	1278	Co –
1230	1333	1417	1397	1193	

Note temp of Drying –

A tube which loaded
8.000 after drying 48 hour
at 212 Fahr Loaded 7662
7700

Ni mix from old cells –
separating flake from Ni –

Chemical	hours		Ni dissolved
K Bichrom	72		none
K Oxalate	72		Much —
K Arsenite	24	green.	All Runs thru filter
K Sulphite	52	V green	Much
K Cy	24	Yellow	"
K Hydrosulphite	52	Green -	"
K Bitartrate	72	"	"
K Iodide	72	Brown	None
K Ferrocy	48	G Tinge	Some
K Sulphite.	48		Some
K Hyposulphite	24	None	None
K Hypophosphorus	48		None
K Lactate	24	green	Much
K Carbolate	96		Some
K Sulfocyanate	96		"
Rochelle Salts	96		"
K Cyanate	96	V green	Much
K Formate	48		None
K Salicylate	30	Large precip sol H_2O.	Some
K Tannate	96		Some
Na Cy	96	Brown	Much
Na Hyposulphite	48		None
Na Sulphite	48		None

Chemical	hours	Ni dissolved
Na Bisulfite	48 – V green	much
Na Salicylate	48	None
Na Sulphocarbonate	96 green	much
Alk flake dissolved, lots Sulphur		—
Na Peroxide	48	none
Na Lactate	48	some
Na Sulphanilate	48	none
Na Sulphiethylate	48 V green	much
Na & K Sulphide	96	none
Na Bicarbonate	48 V green	much
Na Ferrocy	48	Some
Na Tetraoxalate	96 V green	much
Na Persulphate	96 green	much
Na Bromate	96	none
Na Chlorate	—	none
Na glycerophosphate	96	none

3% H_2O_2 gases very much, seperates in about 10 hours no Ni dissolved

Specific gravity	NaOH	KOH
10	1.012	1.083
15	1.170	1.128
20	1.225	1.177
25	1.279	1.230
30	1.332	1.288

1st 50 Hot runs, Comparison between NaOH + KOH old green & Ultimate

	V	½	Difference	% Yours
33%	718	324	—	42.9
31	646	718	+ 72	40.3
29	820	855	35	37.7
27	844	998	154	35.1
25	905	991	86	32.5
23	899	1005	106	29.9
21	904	993	89	27.3
19	933	905	= 28	24.7
17	931	907	= 24	22.1
15	915	907	= 8	19.5
13	881	903	+ 22	16.9
11	855	914	59	14.3
9	813	877	64	11.7
7		830		

21% KOH saturated with LiOH. Contains in 100 cc 2.8586 Milgms LiOH.

15% NaOH saturated contains 3.2936 milgms LiOH —

K Stearate Sol 21% KOH, almost insol in 21% KOH saturated with LiOH.

With the Cobalt Sulfate ~~Sol~~ 3% to 35% Each 5% increase ~~output~~ life 50 Runs —

Reg 7.500 grain soaked in strong Cobalt sol dried & pipd in grain gives loading wts of 7.160 — probably makes it harder & prevents heavy loading by deforming — Eventually use not NaOH will give heavy loading by deforming a porous grain & make gas to burst That must be reason why NaOH worked so surprisingly well when porous filled with $BaSO_4$ etc —
Here is a Clue =

Heavy loading wts in many Cases give only 1090 to 1100 on 50th run

3% Cobalt SO4 up to 35% soaked in Reg Grain gives 7.160 to 7.210 for every degree of strength,
Clue

Practice in working Ni Reg
Soaking in Conc Cobalt Chloride
that it was very difficult
to get the Chloride out many washings
& 4 days soak — Eventually pores
are very fine being filled with
$Co(OH)_2$ & thus circulation very
sluggish for chloride —
Also this must harden grades
& gives low loading cat.

A Later Experiment shows that the
Water used to wt of Ni was
entirely too small.
Mass action probably
Comes in — Using same dish
& 1/10 of the Ni got OK
with 1/5 of the washing
of the big lot.

854 green

2 lbs	Dump	L Wt	5,521
$2\frac{1}{2}$	"		5,902
3	"		6.027
4	"		6 33
$4\frac{1}{2}$	"		6.399
5	"		6 445

.381
.125
.303
.69
46

gain .9 of gram only

3325 =
1164 green mixed with 15% K_2CO_3 Thru 30 mesh
on 190 41 f 48.4 green 134 Dump
L Wt 7000

Cold	50	100	150
883	1180	1387	1183
556	793	870	887

Dup 25% K_2CO_3

Goldzahn 519 = Book 16 - -

25% Cobalt wt 7603
7.565

Cold	50	100	150	200	248	300
927	1370	1507	1467	1460	1430	1360
917	1316	1450	1413	1407	1397	1367

350	400 cold	450 burst
1283	1200	1313
1347	1290	1150

All high Hot

30% Co wt 7652
7602

Cold	50	150
953	1337	1393
933	1390	1383

} Co

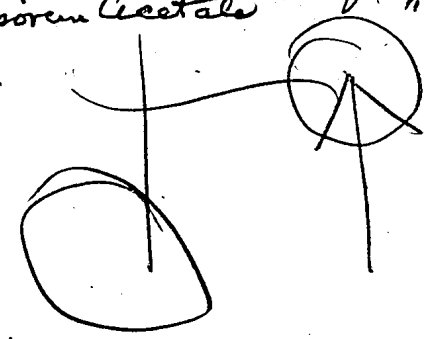
50% Cobalt wt 7362
7516

Cold	50	100	150
783	1287	1327	1290
750	1247	1270	1267

} Co.

Following Mercury Salts soluble
21 KOH 2 L.iOH without precipitation

Phosphoglycerio Acetate	Considerable
Arsenate Hg	Sol
Naphto-Lactate Hg	"
Hg Succinamide	"
Hg Succinate	"
Mercuric Cy	Very Sol
Hg Iodide	"
Hg Salicylate	"
Hg Methylchloride + Ethylchloride	"
Hg Oxycyanide	large amount
Amide-propionate	"
Hg Malate	fair
Mercaptide Hg	Extremely Sol
Asparaguate	Very Sol.
Phenyl acetate	"
Thymolate	Sol
Hg Ferrocyanide	quite Sol.
Hg Resorcin Acetate	"



2 grms Dinitrobenzine –
Cold 1223 } 50 Runs 173 to Volt
1213 } 100
but ½ Volt vs 1633 S S S
1620 : :

Acetanilid 2 grms Cold 1190 50 Hot vs
153 to V ½ vs 1537 S S
183 1510 : :

Picric acid Cold 840 } 50 Hot
137 to V ½ V vs 1427 S Hot 510
130 – 1420 : 440

Benzidine Cold 1060 50 Hot
1037
533 to V 827 to ½
583 767

Hydrochinon
K Silicofluoride
Camphoric acid
K fluoride
Rosolic acid
} 50 Hot vs higher than Cold run

Quinidine
Quinine
Benzophenone
Monobromobenzine
Carbagol
Cresotinic acid
Trichlorophenol
Amidoazobenzine
} higher after 50 runs than Cold

Dinitrotoluol Cold 1157 50 Hot 400 to V
1203 153
½ V vs 1460
1500

Cresol 363 Cold 50 Hot 423 to V
373 440
½ 433
450

Carbon trichloride
Monomethylanaphthalene
Benzenaphtol
Nitroso beta Naphtol
Sodium Stannate
} higher after 50 Hot than Cold

~~Phosphor~~

Telluric acid. Cold 1147 1147 50 Hot
1070 1047 1/2 1090 1063

RA 1052
Green dried in drum from Rolls
mush – Glowing air thru
drum which was heated from
outside; Loading Lots
6.410 S. = Cold 1013 1020
50 Runs 1140 1170 to V 1157 1190 1/2 V –

9 V Miller RA 1189 L wt 6.552
1191 6.456
1194 6.640 1192 – 6.122
1195 – 6.746
1196 – 6.140
1197 6.875

Most gave 1160 to 1200 at
end 150 Runs

Flake coated very lightly with
Antimony by heating it 24 hours in
$SbCl_3$ NH_4Cl

Cold	50	1/2	H	
783	1280	1310	850	L wt 7.460
683	1177	1217	966	

Another –	100	1/2	Hot	
gave high hot 793 – 1293	1100	1160	1053	
cold 907 50 Hot 1220 907	877	917	950	note hot.

RA Lightgrain average L wt 6.200
Run thru Rolls – after being wet with
5% H_2O. 275 Dumps L wt 7.935

New grain book 11 No 2515
treated with Glacial Phosphoric
acid Not [illegible]
Grain 50 Hot 240 100 117
1177 1333 –
Part old Part Nickel
Run returned [illegible]
30 [illegible] [illegible] it
[illegible]

Goldstein

10% Cobalt precip in Cream, Goldstein

Our #4229

L wt	6.686	Cold	50	1/2	H
	6.690 -	777	1020 -	1063	350
		780	1033	1063	350

100	1/2	Hot
1060	1050	367
1087	1097	423

#4231

15% Cobalt in Cream

L wt	6 814	Cold	50	1/2	Hot
	6.890 -	710	1000	1063	403
		714	1020	1063	423

Co

20% L wt 6 644

	Cold	50	1/2	Hot
	390	920	933	420
	387	923	933	420

25% Sig - # 4313

L wt.	7 603	Cold	50	1/2	H
	7 565	927	1370	1400	870
		917	1367	1400	833

100	1/2	Hot	150
1507	1563	920	
1450	1500	867	

200	300	450
1460	1360	1313
1407	1367	1150

4315

30% Cobalt L wt 7602
7652

Cold	50	150	
983	1337	1393	Co
933	1390	1383	

50% Co - L wt 7 362
7 516 -

Cold	50	100	Hot
783	1287	1327	840
750	1247	1270	800

150
1290
1267 -

should have been run longer on brand

4323 Goldstein L wt 7 762
7 831

Cold	50	100	1/2	Hot
1020	1393	1507	1547	897
1012	1367	1523	1570	887

300 Run	450	1/2	Hot
1367	1127	1247	673
1353	1147	1323	700

15/Co	163 per gram	50 ottrum
15	148	
20	133	
25	180	
30	180	
50	170 -	

Unreliable

50% Copper precip mil gram

Cold	50	1/2	Hot
907	1037	1050	407
890	1037	1050	390

50% Barium OH mil gram

Cold	50	1/2	Hot
970	1000	1017	630
977	1017	1033	630

50% Iron

Cold	50	1/2	Hot
193	283	313	50
187	267	297	53

50% Manganese OH.

Cold	50	1/2	Hot
250	497	520	397
250	470	507	397

25% Cobalt precip

Cold	50	150	350	1/2	Hot
1067	1453	1383	1353	1427	863
1083	1490	1400	1340	1440	853

500	1/2	Hot
1190	1377	847
1193	1380	860

Using 1 gm Aluminum in Small Cell — 2KCl is only one that helps
The 1/2 Volt is high

#4472 — Cold

Cold	50	1/2	Hot
1127	653	1533	320
1133	600	1493	323

100 Runs
No disch

4760-1

Conc $NiSO_4$ & 33% NaOH precip + pressed in Cloth, Crushes with fingers
Very bulky Loading lot 6.50 oz
6 557

Cold
923 100
943 1150
1240

Dup pressed in Cake at 100 atmos
L W 6 829
6 82

Cold 100
927 1200
923 1200

Goldskin Mako → # 5 oz
L Wt 7 869 Dry $NiSO_4$ + Dry NaOH
7 865

Made in rolls dried in steam 60 +
80@85 Cent pressed 300 atmos 1/8" Cake

Cold 50 300 500
1200 1303 1430 1347
1223 1343 1467 1333

650 Split + plane some swollen
1110 — badly swollen
943 — badly swollen

Another one 450 700
1433 1123
1193 1013

$Ni(OH)_2$ Leading 8 oz
Dried 212 for 48 hours
Loaded 7 662
7.700

Cold 50 100
1237 1293 1250
1233 1280 1240

Reg Ni —

	Cold	150
3 grm Manganic hydrox	1157	1320
	939	1243

Hot
857
827

	Cold	100
1 grm Manganic in cell	1173	1263
	1157	1260

½	Hot	250
1500	823	1353
1270	857	1330

1 & 3 grm ZnOH, Lower on 50 than on Cold

The sulphate Cobalt.
Series 8% to 35%
average

	50	½	1	Hot
10%	1341	1404		565
15	1342	1415		650
20	1332	1408		675
25	1429	1481		833
30	1420	1473		849

50 Ru

		½	Hot
10	1156	1324	633
15	1271	1416	666
20	1322	1440	732
25	1397	1515	708
35	1377	1491	658

250 Run

		½	Hot
10	1066	1275	577
15	1209	1385	725
20	1226	1378	750
25	1352	1469	776
35	1349	1469	761

300 Run

25½	1077	½ 1338	Hot 662	350
35	1122	1360	704	

25	1243	½ 1445	new fe
35	1267	1457	"

Cold

10	1293	1297	1280
15	1243	1230	1247
20	1273	1290	1310
25	1310	1300	1330
35	1343	1317	1333

Cold of Mn soaked in Cone Cobalt Chl ~~[illegible]~~ 48 hours was

Cold	50	100	200
1057	1277	1393	1467
1020	1287	1393	1480

Comes up slow

600
1490
1367

Dup only soaked about time

Cold	50	200
1263	1367	1133
1257	1350	1193

300
1273
1233

Another soaked Conc CoCl₂ + put on hot plate then in RON

	Cold	50	100
7002	943	1200	1317
7021	977	1190	1260

150
1427
1353 Co

1% Silver Ox precip by Galvanism

	Mod.	Cold	50	100
LW	1440	1093	1283	1350
	1406	1117	1243	1353

250	350	1/2	Hot
1417	1317	1463	723
1400	1313	1396	700

Fe ~ see 2736 Fe book 2500 to 2850
about 1/2 Fe 1/2 Hg

By mistake 350 Test cells were recharged on 450th run + the capacity was greatly increased + this increased capacity held for 200 more runs hot

359
360
361 } increased to 373

Remarks found in a Crumming Holland Fe effecting tests

Same book find a remark
" LiOH 2 gms to 175 cc 21% good on hot test,
Same as above with 5 to 8 gms K_2CO_3 added is better
K elevate sol in 21 KOH test of saturated with LiOH very little K Elevate dissolves

7e – Reg mix 3 grms dried 212°
lost 3/10 of 1%.
This sample stood in air saturated
with moisture absorbed as follows

15 min	6 milg
30	8
45	9
75	11
105	14
135	14
225	14
315	17

Total absd in 5 hour + 17 min
17 milg · 56%

Get Hollands book

Test of a Ni tube provided
with index shows that a
short tube if not restrained
the mix will expand 1/10th
of an inch on charge
One third of this due to
putting in 30 KOH + LiOH
without current. —

Reg short tubes (old) soaked
6 tubes in a gallon of 21% KOH
for a week, showed not a trace
of LiOH in the gallon —
The assay of the tubes showed
over 0.700 milgms of lithia per
tube & 1.800 milg KOH per tube
There is about 1 gram LiOH per
Reg long tube, Holland has record

Tests of a Reg Cell in Water
Changed from time to time
Showed LiOH kept coming
out after KOH was periodically
all removed Holland has record

Developed some green – its
allows too much flowing
green is bad

Both Cobalt & Uranous Hydroxide and Ni mercury Life & Capacity — Neither are reduced by H_2 as Iron will probably not be affected This is not true of Bismuth. Ag.

A Ni_2 graphite charged against a platinum strip gives .750 to Volt & 900 to .3 Volt only gives .375 @ 400 to V when placed close to an Iron Lady probably the free H from overcharge of the iron passes thru holes & reduces the Ni_2O_3 continuously & prevent charge fully

Note if this is true that chg which circulates liquid more rapid should increase this effect, Also A4 having such small electrolyte should have big circulation, perhaps that is reason w3 lose 8% as against short test tube cells & it may be troubles with Bismuth big cells

If all this is true should have a proper sep between Ni & H_2 to keep gases ~~from~~ apart, - Can prove by chg Ni & H_2 sep & use porous cups then assemble & discharge

Graphite Nickel

I say if a 1200 iron fully chgd is placed with a nickel discharged then on charging for say 200 MAH with 100 MA flowing — The nickel will assume that amount of chg The energy loss on H_2 could be great but should be small on the Ni Now on discharg we should get nearly 200 MAH because H_2 has great capacity yet we only get 100 MAH. (gas from H_2 produced Ni chg)

Ni_2O_3 40.67 % Oxygen

NiO 54.23 % "

13.56 % of Oxygen Capacity

7 grams Nickel going from Ni_2O_3 to NiO_2 should give 3000 Mah –
Ni_2O_3 Anhydrous

KOH 21%

Tube fully chg'd quickly rinsed in water
0.357 KOH
When discharged 0.512
Difference 0.155

NaOH 15%
Tube Chg'd 0.267 NaOH
" Discharg'd 0.409 "

Df 142.

	2 hours	3 Hours	4	5	6	7
21 KOH 2 Li OH	391	561	691	797	890	937
	391	562	693	798	893	937
	396	575	711	822	917	960
17 KOH 2 Li OH	370 (393)	540 (566)	677 (698)	778 (806)	862 (900)	910 (940)
	373	542	683	785	867	908
	372	541	687	786	872	938
13% KOH 2 Li OH	358 (375)	495 (541)	650 (682)	746 (783)	830 (867)	872 (919)
	355	485	645	736	825	878
	340	475	622	715	797	857
21 NaOH 2 Li	393	575	738	841	942	976
	386	563	720	821	920	972
	392	570	735	841	937	980
17 NaOH 2 Li	375	555	708	817	910	952
	386	573	742	861	960	1005
	390	574	750	865	970	1015
13% NaOH 2 Li	381	567	730	840	935	970
	381	566	731	842	940	982
	382	568	741	857	950	985

	2 Hrs	3	4	5	6	7	
21% KOH 2 Li	393	566	698	806	900	945	
17% " "	375	541	682	783	867	919	
13% " "	351	482	639	732	817	869	
21% NaOH 2 Li	390	569	731	833	933	976	Average
17 "	384	567	733	848	947	991	
13 "	381	567	734	846	942	979	

	Volt Efficiency	amp Effcy	Watt Effcy	Volt Effcy	amp Effcy	Watt Effcy
21 KOH 2 Li	72	79.7	57.4			
	72.8	79.8	58.1			
	72.9	82.2	60.0	72.6	80.57	58.5
17 KOH 2 Li	72.2	77.8	56.1			
	72.2	78.5	56.6			
	72.2	78.6	56.7	72.2	78.3	56.5
13 KOH 2 Li	71.1	74.6	53			
	71.1	73.6	52.3			
	71.1	71.6	50.9	71.1	73.3	52.1
21 NaOH 2 Li	69	84.1	58			
	68.2	82.1	56			
	68.6	84.1	57.6	68.6	83.4	57.2
17 NaOH 2 Li	70.5	81.7	57.6			
	70	86.1	60.3			
	70.3	86.5	60.8	70.3	84.8	59.6
13 NaOH 2 Li	71	84	59.6			
	71	84.2	59.8			
	71	85.7	60.8	71	84.6	60.1

Old book No 9375 -

18 groups 3 to group of Nickel in small tubes with & without Lithia, Shows on 50 Hot runs that 21K 2 Li gives average 422 on Hot

But Dups with 21K no Li only average Hot 156.

Showing great capacity

Yet 50 Rg Capacity was with Li OH about 100 Watt more than without —

The Li OH, Causes Cell to Take & give a greater change when hot, 2.7 times more

Why

Balance with Li OH 28.9 w/ alkaline & without only 21 now perhaps

93.75 old book

Notice that deference between 50th Run Cap to V & ½ Volt there was a deference between Cap at 1 V & ½ V of only 42.8 Mah when no Li Off was used 21K but when 21K 2 Li used the def was 115.6 Mah

15 groups 3 each used to get averages —

Why 128.9 gone adjusted 21 Li

Can it be that Lithia works on the iron instead of nickel as always supposed

average 15 groups 3 each

The Capacity to V on 50th Run was for 21K 2 Li 1165

for 21K NO Li Off 1186 — S

In this case all the Li Off did was to increase the Hot capacity & ½ Cap

Why

Everything dirty Variable

Important test –

5921 Ni. f group giving 1247 Cold was charged Cold – then heated to 132° for 24 hours & then discharged Cold gave

	1 V	1/2	
24 Hours	1022	1072	9.3 M.a.p. hour
48 "	617	1037	12.6 "
72 "	311	961	12.6 "
96 "	203	908	4.1 "

10 M.a.H. lost per hour

group 5909 Cobalt Flake

Chgd Cold	discharg Hot 1 V	discharg Hot 1/2	Chgd Hot 1 V	discharg Cold 1/2
5.40 green 1180 Cold	741	786	452	495
	756	789	475	512
	777	810	487	522

Nickel flake group

Chgd Cold	discharg Hot 1 V	discharg Hot 1/2	Chgd Hot 1 V	Dis Cold 1/2
5.01 green 1245 Cold	993	999	632	642
	975	987	630	647
	972	984	625	636

#9602 3-Anhydrous Ceric Potassium Sulphate – Stuff all concrete

#9604-5 Manganic Oxide Reduced by Hydrogen

Lot	Cold	50	1/2	Hot
9,480	27	100	103	67
9,562	23	90	97	100

Swollen & Splits.

#9606-7 Anhydrous Tungstic acid reduced by Hydrogen

Lot	Cold	50	1/2	Hot
25 463	33	150	160	157
25 812	37	163	170	167

Anhydrous Titanium Ox – Lot 8402

	Cold	50	1/2	Hot
#9466	13	27	33	33

Ceric hydrox

	Lot	Cold	50	1/2	Hot
#9467-8	6550	3	17	20	33
	6530	3	3	7	11

Molybdic Acid Reduced by Hydrogen

	Lot	Cold	50	1/2	Hot
#9469-70	14710	76	53	57	60
	14680	67	67	70	60

Anhydrous Cobalt Peroxide

9471-2 wt 10230
10240

Cold	50	1/2	H		1/2	H
				297	309	263
90	167	250	217	300	320	240
90	173	257	217			

100	1/2	H
330	425	310
337	537	310

Run as Mono

600	1/2	
600	1340	
	1365	

150	1/2	200	1/2	Hot
685	1310	665	1414	525
675	1355	600	1420	500

9473-4 - wt 1745
17380

Anhy Uranous Dioxide

Cold	50	1/2	Hot
17	0	33	17
10	0	33	17

Anhyd Chromic Ox reduced by # 9475-6
wt 9500
9524

Cold	50	1/2	H	
63	23	27	50	
63	27	30	50	

9477 - Anhydrous Neodymium Ox
flakes with air wt 8950

Cold
3

Busted, bad Swollen

9401 Thorium Ox Anhyd
17693
Pressed 17407

Cold	50	1/2	H
13	70	87	57
13	93	127	83

Lanthanum La_2O_3 Anhy wt 8.028
Pressed

Cold	50	1/2	H
23	47	53	67

Ce_2O_3 Anhy 9405-6 wt 7521
7604

Cold	50	1/2	H
7	23	27	20
7	17	20	0

Uran hydroxide wt 10340
10373
9407

Cold	50	1/2	H
10	17	20	17
10	33	37	30

Cr_2O_3 Anhy Wt 7690 # 9409-10
7633

Cold	50	1/2	H
3	0	0	7
3	1.5	0	7

8797-8 = Uranium Hydrox 75 parts
Nickel hydrox 25 parts
Wt 9670-9700 —

Cold	50	1/2	H
153	323	330	210
147	327	333	210

8799-8800 Uranium Hydrox 75 pts
Bismuth Hydrox 25
Wt 11515 = 11805

Cold	50	1/2	H
3	87	110	37
3	87	110	37

Nickel Meta Vanadate # 8793-4 Wt 6155

Cold	50	1/2	Hot
197	107	110	137
197	103	110	133

Uranium Hydrox 75 pts Cobalt Hyd
25 parts # 8803-4

Cold	50	1/2	H
60	90	110	93
53	67	90	97

Uranium Hydrox 00
Thallium Iodide 00
Iron Vanadate 00
Tungsten Bronze 00

NiOH from precip Nickel Oxalate NG
" " Nickel phosphate NG
Low Load + poor Capacity
750 to V 50th Rm

8929 – $Ni(OH)_2$ pp from Nickel Borate

Wt 7320
7257 Capacity about 1130

from Nitrate Cap 1067 wt 6024
" Arsenate " 1070 wt 6920

Ca phos
Ba phos
Sr phos
Ca Carbonate
Ba "
Sr "
Ca Borate
Ba "
Sr "

} used with Nickel flake like reg ni
all give capacity less than 30 mah

NaOH. 2 LiOH -

	Coll	50	100	150	200	250	300
27	1070	670	481				
25	990	841	689				
23	1286	1028	822	540	343		
21	1257	1264	1090	792	553		
19	1267	1307	1261	1062	707		
17	1250	1255	1285	1117	868		
15	1209	1244	1204	1202	1030	978	
13	1219	1190	1117	1073	949	826	
11	1193	1123	1023	959	819	718	
9	1184	1106	970	919	827		

KOH 2 LiOH.

27	1337	1362	1367	1300	1144	1193	1051
25	1316	1316	1356	1079	965	1232	1142
23	1239	1275	1316	1295	853	1221	1135
21	1190	1222	1220	1045	—	1010	1038
19	1175	1212	1182	1053	—	942	
17	1157	1183	1090	992	893	714	
15	1153	1139	1021	844	800	621	
13	1174	1161	1026	771	766	655	
11	1159	1129	1016	464	665	510	
9	1116	1108	999	652	467	476	

15% 2 Li for NaOH
25% 2 Li for KOH.

first from this

2)1262
631

2)637
318

2)649
324

187
237
2)424
212

2)949
474

2)637
318

2)949
474

1450 40 580

1450 580 2036 1624

2038 1875 1875 20 375 1500 24 2

1500 40 680

2100 680

2/350 174

1720 18

2100 1680 93

2240 1792 34

473 2/284 473

2/10000 5000

1720 376

1720 1376 1376 1376 2848 1584 2848 2

1930 120 386 1930 2316

200

150

2000

240 211 29

2/1590 795

28

no

Zn

Fe

14 40 56

5000) 34000 30000 4000 (168

Zn

1/2

1260 40 504

1260 504 1764 120 352 1764 216

1433 40 572

1433 573 2006 120 401 206 2407

dis Zn Heat,

on charge Zn immediat

heat Ni-

[ITEM(S) FOUND IN BOOK]

FEB 24 1910

Ni re. Exp. #1752-74.

Mr. Edison: You wrote me last week about trying a small cell with an Fe pocket short-circuited to a Ni tube as the positiv electrode and the same for the negativ electrode. I had 3 cells made of new tubes and Fes, positioned in glass jars like sketch-[pd] Filled these with 21 oz. KOH + 11.2 g. SiOH per l. and ran as regular tube cells with following results:

RUN	CELL A		CELL B		CELL C		AVERAGE		
	1V	.5V	1V	.5V	1V	.5V	1V	.5V	
1	963	1147	963	1147	983	1160	970		
2	1147	1317	1133	1310	1127	1293	1136		
3	1160	1310	1150	1317	1167	1300	1159	1309	
4	917	1033	843	967	920	1033	893	1011	- Monday run.
5	1110	1277	1110	1277	1110	1237	1110	1264	
6	1120	1290	1117	1283	1097	1233	1111	1269	

Voltage averaged 1.16 on these tests.

The volt curve did not drop straight down from 1V to .5V but had a tail, showing, I think, that the Fe gave out first because it did not get fully charged. The tube which is in front of the Fe would naturally shunt some of the charging current.

Will now try these for holding their charge and then will reverse

the polarity and see what happens.

W. E. M.

[ITEM(S) FOUND IN BOOK]

5.13 mult to 1 mat

1480

51.3 5.13 | 760000
5.13
2472
2052
4198
3594
3999

1192 | 6122
5960
1620
1192
428

5.13

1440

[ITEM(S) FOUND IN BOOK]

KOH

	Cold	50	100	150
33	1123	718	639	550
31	1095	641	670	583
29	1075	820	766	720
27	1032	844	840	826
25	1012	905	909	908
23	986	899	917	922
21	975	904	927	932
19	959	933	946	975
17	934	931	942	968
15	899	915	939	960
13	869	881	914	935
11	828	855	882	885
9	753	813	801	825

NaOH

29	802	855	712	
27	1058	998	803	
25	1132	992	843	
23	1080	1015	907	
21	1047	993	905	
19	1007	905	856	859
17	982	907	887	864
15	944	907	889	878
13	902	903	903	885
11	870	914	900	861
9	816	877	862	791
7	794	829	798	719

[ITEM(S) FOUND IN BOOK]

7291 — 1247

1% Co [illegible] - Dried Open box 30 days (Col) 1227 — 1347 50 1483 100

250 1350 — 300 1267 450 1313 500 1050 — (Col) [illegible]

Load wt 7,360 -

Strong Lada - Dried box 1 hole 30 days 7,816 -

Made with 520 g MeOH. 1 hole in box 30 days 7,016

CoSO4 — soaked grain

	50	100	150	200	250	300	350
3% Co	1323 -	1347	1367	1117			
5% Co	1373	1307	1373	1163			
7% Co	1343	1290	1340	1213			
10	1327	1273	1367	1320	1220	1153	1240
15	1300	1243	1350	1423	1350	1227	
20 %	1347	1347	1313	1353	1327	1153	
25	1347	1430	1430	1467	1447	1347	1163
35	1410	1333	1397	1440	1343	1297	1350
							1100
							1287

L Wt 7,420 -

Every 5% add 50 Rum

~~Loading wt same no matter what %~~

go to next sheet

[ITEM(S) FOUND IN BOOK]

~~L Wt 7.500 –~~ 10 Hat 1117

3% Comgrain 7193.
5 " 7.193
7 7.136
10 7.175
15 7.164
20 7 220
28 7.202
35 – 7.170

Co weaker L Wt less = danger of quench – avoided

Reg – 7.713 – 50 1153
" 7.740 1090 – 1133
7.835 1077 – 1060 –
7.937 1067 – 1120

Dry NaSO4 Dry Kaoth. poured to Coke –
L Wt 6765 – 50 1177 – 1190 100 1237 – 1197 –

Another Quenched in conc Coal – L Wt 7.060 –
" " " 7.000 –

1½ Agl – good